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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: AMYLASES, NUCLEIC ACIDS ENCODING THEM AND METHODS FOR MAKING AND USING THEM

(57) Abstract: Polynucleotides encoding variant amylase polypeptides along with methods of using the same are provided.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/33150

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : C12 Q3/00, 1/68; C12P 21/06; C12N 9/00, 9/24, 9/44, 1/20, 15/00; C07K 1/00; C07H 21/04
US CL : 435/4, 6, 41, 183, 200, 210, 252.3, 320.1; 530/350; 536/23.2, 23.3, 23.7
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 435/4, 6, 41, 183, 200, 210, 252.3, 320.1; 530/350; 536/23.2, 23.3, 23.7

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KIM C.H. et al. Purification and biochemical characterization of pullulanase type I from Thermus caldophilus GK-24, FEMS Microbiol. Lett., 1996, Vol.138, No. 2-3, pages 147-152.	1-63, 70-118
X --- Y	LADERMAN K.A. et al. The purification and characterization of an extremely thermostable alpha-amylase from hyperthermophilic archaebacterium P.furiosus, J. Biol. Chem., 1993, Vol. 268, No.32, pages 24394-24401.	1-63, 70-118
X --- Y	NARANG S et al. Thermostable alpha-amylase production by an extreme thermophile B.thermooleovorans, Lett. Appl. Microbiol., 2001, Vol. 32, pages 31-35.	1-63, 70-118
X --- Y	MALHOTTRA R et al. Production and partial characterization of thermostable and calcium-independent alpha-amylase of an extreme thermophile B.thermooleovorans NP54, Lett. Appl. Microbiol., 2000, Vol. 31, pages 378-384.	1-63, 70-118

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
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Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-63, 70-118, SEQ ID NO:1 &2 only

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group 1, claim(s) 1-63, 70-118, drawn to polynucleotide with SEQ ID NO:1 encoding the polypeptide with SEQ ID NO:2, vectors, host cells comprising the same, probes and method of making the polypeptide and methods of using said polynucleotides and polypeptides.

Group 2, claim(s) 1-63, 70-118, drawn to polynucleotide with SEQ ID NO:5 encoding the polypeptide with SEQ ID NO:6, vectors, host cells comprising the same, probes and method of making the polypeptide and methods of using said polynucleotides and polypeptides.

Group 3, claim(s) 1-63, 70-118, drawn to polynucleotide with SEQ ID NO:7 encoding the polypeptide with SEQ ID NO:8, vectors, host cells comprising the same, probes and method of making the polypeptide and methods of using said polynucleotides and polypeptides.

Group 4, claim(s) 1-63, 70-118, drawn to polynucleotide with SEQ ID NO:11 encoding the polypeptide with SEQ ID NO:12, vectors, host cells comprising the same, probes and method of making the polypeptide and methods of using said polynucleotides and polypeptides.

Group 5, claim(s) 1-63, 70-118, drawn to polynucleotide with SEQ ID NO:13 encoding the polypeptide with SEQ ID NO:14, vectors, host cells comprising the same, probes and method of making the polypeptide and methods of using said polynucleotides and polypeptides.

Group 6, claim(s) 1-63, 70-118, drawn to polynucleotide with SEQ ID NO:15 encoding the polypeptide with SEQ ID NO:16, vectors, host cells comprising the same, probes and method of making the polypeptide and methods of using said polynucleotides and polypeptides.

Group 7, claim(s) 64-69, drawn to transgenics comprising the polynucleotide with SEQ ID NO:1.

Group 8, claim(s) 64-69, drawn to transgenics comprising the polynucleotide with SEQ ID NO:5.

Group 9, claim(s) 64-69, drawn to transgenics comprising the polynucleotide with SEQ ID NO:7.

Group 10, claim(s) 64-69, drawn to transgenics comprising the polynucleotide with SEQ ID NO:11.

Group 11, claim(s) 64-69, drawn to transgenics comprising the polynucleotide with SEQ ID NO:13.

Group 12, claim(s) 64-69, drawn to transgenics comprising the polynucleotide with SEQ ID NO:15.

The inventions listed as Groups 1-12 do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The ISA considers that where multiple products and processes are claimed, the main invention shall consist of the first invention of the category first mentioned in the claims and the first recited invention of each of the other categories related thereto. Accordingly, the main invention (Group 1) comprises the first-recited product, a polynucleotide with SEQ ID NO:1 encoding polypeptide with SEQ ID NO:2, a vector, a host cell, a method for producing polypeptide and other methods. Furthermore the ISA considers that any feature which the subsequently recited products and methods share with the main invention does not constitute a special technical feature within the meaning of PCT Rule 13.2 and

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that each of such products and methods accordingly defines a separate invention.

of B. FIELDS SEARCHED Item 3:
CAPLUS, EMBASE, MEDLINE, SCISEARCH, USPTO WEST, BIOTECHNO, BIOTECHABS, CANCERLIT, GENBANK.